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COROLLARY. Let $\alpha = \frac{1}{2}\pi$; then $\Delta = \frac{b^2}{2\pi}$, the same as problem 26.

[NOTE.—By mistake in numbering the problems in this department, number 28 was omitted. The above problem and solution are inserted that problems be numbered consecutively. EDITOR.]

29. Proposed by JOHN DOLMAN, Jr., Philadelphia, Pennsylvania.

Neglecting perturbations, what is the average distance of the earth from the sun ?

Solution by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

The focus being the pole, the polar equation to the ellipse is

$$r = \frac{a(1-e^2)}{1-e\cos\theta} \quad \ldots\ldots\ldots\ldots (1).$$

I. The radii vectores being drawn at equal angular intervals,

$$m' = \frac{\int r d\theta}{\int d\theta} = a(1-e^2)\frac{\int_0^\pi \frac{d\theta}{1-e\cos\theta}}{\int_0^\pi d\theta} = a\sqrt{1-e^2} = b.$$

II. If x be the abscissa of any point on the curve, the focal distance is

$$r = a - ex \quad \ldots\ldots\ldots\ldots (2),$$

$$\text{and } m'' = \frac{\int_{-a}^{+a}(a-ex)dx}{\int_{-a}^{+a}dx} = a,$$

the points on the curve being so taken that their abscissas increase uniformly.

III. If the number of radii vectores depends upon the length of the curve,

$$m''' = \frac{\int r ds}{\int ds},$$

ds being an element of the curve.

Also solved as I. above by *Profs. F. P. MATZ*, and *O. W. ANTHONY*, and as III. by *Prof. G. B. M. ZERR*.

PROBLEMS.

37. Proposed by HENRY HEATON, M. Sc., Atlantic, Iowa.

Required the average area of all triangles two of whose sides are a and b.

38. **Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics, Drury College, Springfield, Missouri.**

Two arrows are sticking in a circular target: show that the chance that their distance is greater than the radius of the target is $3\sqrt{3}/4\pi$. [From *Todhunter's Integral Calculus*, page 335.]

MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

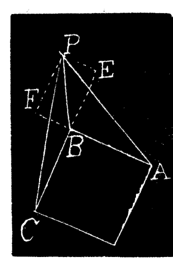
SOLUTIONS OF PROBLEMS.

33. **Proposed by Prof. ALEXANDER ROSS, C. E., Sebastopol, California.**

From a point P without a square field ABC, the distances PA, PB, and PC measured to the corners are, respectively, 70, 40, and 60 chains. What is the area of the field ?

I. **Solution by A. H. BELL, Hillsboro, Illinois, and A. H. HOLMES, Brunswick, Maine.**

Let $a>b>c$ equal the distances 70, 60, and 40, and let $x=a$ side of the square field. Then $\cos A=\dfrac{a^2+x^2-c^2}{2ax}$, and this multiplied by $a=AF=\dfrac{a^2+x^2-c^2}{2x}$. $AF-AB=BF=EP=\dfrac{a^2-c^2-x^2}{2x}$;



then, also, $BE=\dfrac{b^2-c^2-x^2}{2x}$.

$$\therefore\ \frac{(a^2-c^2-x^2)^2+(b^2-c^2-x^2)^2}{4x^2}=c^2 \ldots\ldots\ldots\ldots\ldots(1).$$

$$x^4-(a^2+b^2)x^2=c^2(a^2+b^2)-\frac{a^4+b^4+2c^4}{2} \ldots\ldots\ldots(2).$$

$$\text{Area of square}=x^2=\tfrac{1}{2}\left[a^2+b^2\pm\sqrt{4c^2(a^2+b^2-c^2)-(a^2-b^2)^2}\right]\ldots(3).$$

Then area required$=(8500\pm6516.901)\div2=750.84\frac{1}{2}$ or 99.155 acres.

The second is the value required; the other is for point within the field.

II. **Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Applied Science, Texarkana College, Texarkana, Arkansas-Texas.**

Let $ABCD$ be the square, $OA=70=a$, $OB=40=c$, $OC=60=b$, O the origin, (x, y) co-ordinates of A, (u, v) co-ordinates of C, $\angle ABE=\theta$, $\angle EBC=\frac{\pi}{2}-\theta$.

$$\therefore\ (x-c)^2+y^2=(u-c)^2+v^2,\ x^2+y^2=a^2,\ u^2+v^2=b^2 \ldots\ \ldots\ldots(1, 2, 3).$$